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SHORTER ARTICLES AND DISCUSSION

ON THE FAUNA OF GREAT SALT LAKE

IN a recent number of the AMERICAN NATURALIST[1] appeared a paper entitled "Notes on the Fauna of Great Salt Lake," by Dr. Chas. T. Vorhies. From observations made by the present writer in the region at the mouth of Bear River, Utah, during the summer and fall months from 1914 to 1916 inclusive, information is available that supplements in part the data given by Dr. Vorhies.

Bear River, the largest of the three main tributaries of Great Salt Lake, breaks up into a series of channels at its mouth and forms a great delta at the northern end of Bear River Bay. Immediately below the mouth of the river the waters of the bay are freshened by the incoming river water. Conditions here vary greatly however from day to day, and at present heavy salt water frequently comes up as far as Slaughter Island at the lower part of the marsh area in the river delta. Below this point the surface water coming from the river may be fresh while at a depth of a few inches a stratum of brine may overlie the mud. On calm days this overlapping proceeds for long distances. The prevailing summer winds however are from the south and southwest and these drive the salt water in toward the marsh nearly every afternoon.

It is common belief that the Southern Pacific cut-off has served as a dam to separate Bear River Bay from the main lake (cf. Vorhies, p. 494). For a considerable distance this causeway is made up of trestle work allowing free interchange of water from either side. Although tests of the density of the water were not made, the writer is certain that the difference in content of salts between the water on the north and south sides of the cut-off is slight while water sufficiently saline to enable the life characteristic of the Lake to flourish is found at least twelve miles above the cut-off and within four or five miles of the point at which the main channel of Bear River opens into what is known as South Bay.

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[1] Vol. LI, No. 608, August, 1917, pp. 494–499.

Brine shrimp, *Artemia fertilis* Verrill, occurred at this point in enormous numbers and adults and larvæ of alkali flies, *Ephydra gracilis* Packard and *E. hians* Say, were abundant. *E. subopaca* Loew was less common. The brine shrimp were gathered in great masses, and took advantage of the slightest depressions in the mud as shelters against the ever-fluctuating currents. Thousands frequently gathered in the lee of the boat during periods of observation by the writer.

In May and June adult *Ephydra* were found on mud, laid bare by water receding from the high spring levels, in which alkalis were rising through surface evaporation. On these areas the flies formed dense masses several feet square. The insects were busily probing or kneading the mud with their proboscides so that the surface was heavily pitted or stippled with small depressions that were visible at a distance of several feet. The greater part of these insects were *Ephydra gracilis.*

The statement made by Dr. Vorhies (p. 498) that "enemies play no part in keeping down the numbers of *Artemia,* or of *Ephydra* in the larval stage" is not corroborated by observations of the present writer. After the first of September each year shovelers, *Spatula clypeata* (Linnæus), began to congregate in the bay below the mouth of Bear River, and by October 1 thousands of these ducks were present. The birds lay in great banks on the open water, and it was not unusual to see such flocks that were at least two miles long and from one quarter to one half a mile broad. The shovelers were feeding almost entirely upon *Artemia fertilis* and larvæ and pupæ of *Ephydra,* and were crammed with them constantly. Usually this species of duck is not a good table bird but individuals shot here were all exceedingly fat, and the writer found them excellent eating. These ducks remained in fall until the fresh water bays were covered with ice. Another species of duck, the lesser scaup, *Marila affinis* (Eyton), came into this region from the north between October 2 and 12 each year, and by October 20, was abundant. These lesser scaups also frequented the lower bay, and, like the shovelers, fed to a large extent upon the brine shrimp and the immature stages of the alkali flies. At dusk on October 14, 1914, flocks of these ducks were observed from Promontory Point passing from Bear River Bay southwest past Fremont Island in the open lake. As there is no fresh water feeding ground in that direction it was assumed that they were going out to feed at some favorable locality in the lake. Later in October the other ducks were joined by American goldeneyes, *Clangula c. americana* Bonaparte, while from observations it was certain that the green-winged teal, *Nettion carolinense* (Gmelin), at times fed upon this same food. The number of crustaceans and fly larvæ destroyed by these birds must be enormous.

In addition to these ducks great flocks containing thousands of Wilson's phalaropes, *Steganopus tricolor* Vieillot, and northern phalaropes, *Lobipes lobatus* (Linnæus), are found on the salt water during migrations, where these birds likewise feed upon the brine shrimp and the fly larvæ and pupæ. During October and November flocks of eared grebes, *Colymbus nigricollis californicus* (Heermann), were found on the lake along the cut-off where their food must have been taken from the same supply as none other suitable is found. It may be mentioned here that a considerable number of shovelers and many thousand eared grebes winter on Owen's Lake in California, where saline conditions are similar to those in Great Salt Lake, and where a similar fauna is found.

Avocets, *Recurvirostra americana* Gmelin, and black-necked stilts, *Himantopus mexicanus* (Müller), also fed upon *Artemia* and *Ephydra* at the mouth of Bear River, and no doubt these animals furnished food to other shore birds. Definite data on this point is not at hand, however, as all of the shore bird stomachs collected there have not yet been examined. It is probable that the ring-billed gull, *Larus delawarensis* Ord, and California gull, *Larus californicus* Lawrence, also take this same food at times.

From the facts outlined above it will be seen that the toll taken by birds from the brine shrimp and alkali fly larvæ and pupæ during the course of a season constitutes a mass of individuals almost beyond comprehension. The digestion of food by the birds concerned is always a rapid process, and with soft-bodied animals like the brine shrimp a considerable mass would be consumed each day; and the same is true of the larvæ and pupæ of the alkali flies. The immense number of these creatures in the waters of the lake must be attributed to the large number of offspring produced rather than to an absence of enemies.

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